**Career Academy Integrated Unit Plan**

**Academy Name:** Plant Biotechnology STEM **School:** University High School

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| Integrated Unit Plan Title: The Mystery of Ms. Garcia |
| Courses to integrate: Geometry, Algebra II, Chemistry, Plant Biotech |
| Grade Level: 10th |
| Timeline & Duration: Weeks 5-9, first grading period |
| Essential Question: How are principles of plant biotechnology utilized to process and analyze key information within a crime scene? |

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| Unit Summary: Using Chemistry, Geometry, and Algebra in order to analyze and solve a forensics mystery within Plant Biotechnology. |

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| **Overview of Activities/Lessons per Course** | | | | |
| **Course** | **Agriscience Foundations** | **Chemistry** | **Geometry** | Algebra |
| Activity/Lesson | Introduction to applications of forensics in plant biotechnology/review of DNA/introduction to Ms. Garcia scenario | Students will be introduced to the molecular structure of DNA through power point presentation | Use inductive and deductive reasoning to determine the logical steps when analyzing a crime scene | Students will use parallelism and perpendicularity to analyze a crime scene. |
| Activity/Lesson | Micropipetting technique/measuring small volumes | Students will engage in an introductory DNA electrophoresis lab | To gather data to determine if there is a relationship between foot length, leg length and height of a person when analyzing a footprint at a crime scene. | Lengthy Relationships Lab: Students will gather data and determine if there is a relationship between foot length, leg length and height. |
| Activity/Lesson | Introduction to gel electrophoresis | Students will test soil for pH level from garden and suspect’s kitchen by engaging in pH lab |  |  |
| Activity/Lesson | Making electrophoresis buffer and casting gels/running a gel |  |  |  |
| Activity/Lesson | Using PCR to amplify DNA in forensic analysis |  |  |  |
| Activity/Lesson | Interpretation of DNA bands/comparing against a normal ladder resulting from gel electrophoresis/comparing animal/human DNA to plant DNA in a gel |  |  |  |
| Activity/Lesson | Conclusion: How to write up scientific data/students will perform as forensics experts to report their findings |  |  |  |

**Lesson Instructions for Plant Biotechnology:**

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| **Standards (Performance Tasks or Course Frameworks or Sunshine State Standards ):**   1. Apply scientific and technological principles to agriscience issues --The student will be able to:   This standard supports the following Next Generation Sunshine State Standards:SC.912.E.7.8; SC.912.L.14.2, 3, 4, 5, 6, 8; SC.912.L.15.14, 15; SC.912.L.16.1, 2, 3, 4, 7, 9, 10, 12, 14, 15, 16, 17; SC.912.N.1.1, 2, 3, 4, 6, 7; SC.912.N.2.2, 5; SC.912.N.3.1; SC.912.N.4.1; MA.912.S.3.1, 9; MA.912.S.4.2; MA.912.S.5.1, 3; MA.912.S.5.2, 3, 4, 5  03.01 Employ scientific measurement skills.  03.02 Demonstrate safe and effective use of common laboratory equipment.  03.05 Implement the scientific method and science process skills through the design and completion of an agriscience research project.  03.06 Interpret, analyze, and report data.  03.07 Investigate DNA and genetics applications in agriscience including the theory of probability.   * 1. Evaluate advances in biotechnology that impact agriculture (e.g. transgenic crops, biological controls, etc.). |
| **Rigor & Relevance (quadrant):** D – Adaptation |
| **Instructions to Teacher:**   * The teacher will ensure that copies are made for the students ahead of time for all lab sheets. * Teacher will review content that is being taught in chemistry and math just to make sure that everyone is on the same page, if there happen to be students mixed in the class who don’t have the STEM teachers and aren’t receiving the other pieces of the integrated content. * Labs will be set up ahead of time with all materials. * Teacher will show students how to make buffer and gels so they can learn the process, therefore some of that preparation will be class demonstration, the rest can be done ahead of time in preparation for the lab activities. * Teacher will review lab safety and the scientific method briefly in preparation for the activities within the unit. |
| **Instructions to Students:**   * Students will take notes during all direct instruction/PowerPoint presentations. * Students will keep a legal scientific notebook with all documentation of the data collected in this unit. * Students will work with teacher-assigned lab groups and be responsible for set-up/clean-up of all materials used during the lab activities. * Students will complete lab activity sheets for each assignment as mini-assessments. |
| **Instructions for Student Accommodations:**   * Students will have lab partners, strategic grouping if necessary. * Students will receive copies of PowerPoint presentations if necessary. * Students will have lab sheets as well as the pertinent information posted on the board. * The teacher will provide verbal assistance when necessary. * Extended time provided for students when necessary. |
| **Assessment for Activity:** Scientific reporting in the form of a formal lab report, final presentation with PowerPoint, and a court-style debate. Students will report their findings from the entire project, analyzing the situation, findings, and general reporting of the data they collected throughout the unit. Students will create a conclusion about who committed the crime and support this with their data. The class will be divided as “defense” and “prosecution” and debate their findings as they are in their final stages of analysis of the data. They will then write up the final report explaining how they believe Ms. Garcia died and how the data supports the conclusion. |
| **Approximate Length of Time for Activity:** 4 weeks to complete the unit. |
| **Materials Needed:**  Onion cells/DNA (onions)  Bovine blood samples  DNA ladder  Gel electrophoresis boxes and gel casting trays/combs  Power supply  Stain for the gels  Imaging system  TBE buffer  DNA grade agarose powder  Table top balance  Graduated cylinder, 250 mL  Micropipetor, 10uL, 20uL  Test tubes  Microtubes  Deionized water  Food coloring  PCR primers/enzymes  Spectrophotometer  Cuvettes |
| **Resources Needed:**  Ms. Garcia resource sheet  Worksheets for students  Computers  Projector  Lab equipment |
| Attachments: Student worksheets  Individual lesson plans for each activity |

**Lesson Instructions for Chemistry:**

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| **Standards (Performance Tasks or Course Frameworks or Sunshine State Standards ):**SC.912.N.1.2-7; SC.912.N.2.2; SC.912.N.3.1;SC.912.N.3.5;SC.912.N.4.2;LA.910.2.2.3;SC.912.P.8.2;SC.912.P.8.7  **Rigor & Relevance (quadrant):** A, C |
| **Instructions to Teacher:**  Activity1: teacher will begin DNA lesson with CSI/forensic video to introduce how DNA is used in a forensic investigation. Teacher will then provide power point to deliver necessary introductory information for DNA. Practice worksheets will reinforce this information.  Activity 2: electrophoresis introductory lab.  Activity 3: along with preliminary pH information, teacher will set up pH probes, onions with necessary soil attached, and indicators. Teacher will provide laboratory protocol. Rubric will be used for laboratory write up. |
| **Instructions to Students:**   * Students will take notes on DNA * Students will participate in both activities in group settings. They will be responsible for reading, interpreting, setting up, and implementing lab. Detailed observations must be recorded during labs, and then used for final lab write up which will include a conclusion. Rubric will detail necessary components to include. |
| **Instructions for Student Accommodations:** |
| **Assessment for Activity:**  Activity 1: worksheets, and summative test  Activity 2: detailed lab write up assessed with rubric  Activity 3: detailed lab write up assessed with rubric |
| **Approximate Length of Time for Activity:**  Total time for all three activities will encompass 4 weeks time |
| **Materials Needed:**  Materials include power point notes, worksheets, lab protocols, and rubrics. See attachments |
| **Resources Needed:**  Power point presentation, computer, projector  See attachment for necessary lab materials |
| **Attachments: worksheets, lab protocols, rubrics** |

**Lesson Instructions for Geometry (course):**

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| **Standards (Performance Tasks or Course Frameworks or Sunshine State Standards ):**  MA.912.D.6.3/MA.912.6.4 Determine whether a given short proof is logically valid.  MA.912.G.8.3 Determine if a solution is reasonable based on the given situation  MA.912.G.8.4 Make conjectures and justify and support the conjectures with geometric proofs  MA.912.G.8.2 Use a variety of problem solving strategies to include diagramming, charting, trial and error.  **Rigor & Relevance (quadrant):** Quadrant B – Students use acquired knowledge to solve problems, design solutions, and complete work. The highest level of application is to apply knowledge to new and unpredictable situations |
| **Instructions to Teacher:** Teacher will prepare the lesson by following the logical steps in processing a crime scene. |
| **Instructions to Students:** Students will use trial and error, process of elimination, and logical reasoning to solve a real world problem. |
| **Instructions for Student Accommodations:** Teacher-led activity, Group Activity, Group Discussion, Extended time for students when needed. |
| **Assessment for Activity:** Cumulative group project will be graded in Biomedical and Plant Biotechnology STEM class |
| **Approximate Length of Time for Activity:** 4 weeks |
| **Materials Needed:** pencil, notebook |
| **Resources Needed:** Mystery of Isabella Garcia resource sheet. |
| Attachments: |

**Lesson Instructions for Geometry activity 2 (course):**

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| **Standards (Performance Tasks or Course Frameworks or Sunshine State Standards ):**  MA.912.G.8.2 – demonstrate and use a variety of problem solving strategies to include diagramming, charting, equation writing and solving, trial and error  MA.912.G.8.3 – determine if a solution is reasonable based on the given situation  MA.912.G.8.4 – make conjectures and justify and support the conjectures with geometric concepts  MA.912.D.11.5 – use algebra to apply theorems where segments are divided proportionally  MA.912.g.2.4 – do ratio and proportion practice  **Rigor & Relevance (quadrant):** Quadrant B – Students use acquired knowledge to solve problems, design solutions, and complete work. The highest level of application is to apply knowledge to new and unpredictable situations |
| **Instructions to Teacher:** Teacher will print up the lab procedures for the students. Teacher will set up a 20 meter section of hallway where the students will collect their data. Get the students working in teams to measure the heights and corresponding foot lengths of each other |
| **Instructions to Students:** Gather data. Calculate ratios. Plot data on scatter plots. Describe patterns and examine graphs to determine if there are relationships between the variables. |
| **Instructions for Student Accommodations:** Teacher-led activity, Group Activity, Group Discussion, Extended time for students when needed. |
| **Assessment for Activity:** Cumulative group project will be graded in Biomedical and Plant Biotechnical STEM class. |
| **Approximate Length of Time for Activity:** 4 weeks |
| **Materials Needed:** meter stick, graph paper, notebook, calculator, pencil |
| **Resources Needed:** Lengthy relationships lab handout. |
| Attachments: |

**Lesson Instructions for Algebra - activity 1:**

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| **Standards (Performance Tasks or Course Frameworks or Sunshine State Standards ):**  MA.912.A.3.11 – determine the slope of a line in terms of the data  MA.912.G.1.4 – use coordinate geometry to find slopes, parallel lines, perpendicular lines and equations of lines  MA.912.A.3.10 – find the equation of a line parallel or perpendicular to a given line through a given point on the new line  **Rigor & Relevance:** Quadrant B: Application – Students use acquired knowledge to solve problems, design solutions, and complete work. The highest level of application is to apply knowledge to new and unpredictable situations |
| **Instructions to Teacher:**  Teacher will prepare PowerPoint slides for handout, review finding slope(algebraically and geometrically), present the PowerPoint presentation, facilitate discussion and analysis of Ms. Garcia’s door. Send report of results to teammates. |
| **Instructions to Students:**  Students will calculate slopes (algebraically and geometrically) to confirm the relationship between opposite and consecutive sides of doors. Students will use this relationship to determine if Ms. Garcia’s door was tampered with. |
| **Instructions for Student Accommodations:**  Strategic grouping of students; Review PowerPoint when requested; Behavioral Strategies; Classroom placement/arrangement; Extended time for students when needed; organizational strategies; and technology usage. |
| **Assessment for Activity:**  Cumulative group project will be graded in Plant Biotechnology STEM class. |
| **Approximate Length of Time for Activity:**  One 50 minute class period |
| **Materials Needed:**  Pencil, calculator, PowerPoint presentation slides, writing equations worksheet |
| **Resources Needed:**  Computer, projector, and PowerPoint presentation |
| Attachments: PowerPoint Presentation; writing equations handout |

**Lesson Instructions for Algebra - activity 2 :**

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| **Standards (Performance Tasks or Course Frameworks or Sunshine State Standards ):**  MA.912.A.3.8 - graph scatter plots and determine correlations  MA.912.g.2.4 – do ratio and proportion practice  MA.912.A.3.11 – use lines of best fit (trend lines) to make predictions  MA.6.A.2.2 - compare ratios using proportions  **Rigor & Relevance:** Quadrant B: Application – Students use acquired knowledge to solve problems, design solutions, and complete work. The highest level of application is to apply knowledge to new and unpredictable situations |
| **Instructions to Teacher:**  Teacher will print up the lab procedures for the students, review key concepts of ratios and proportions, arrange students into lab groups and facilitate the student guided lab. Send report of results to teammates. |
| **Instructions to Students:**  Students will gather data, calculate ratios, plot data on scatter plots, describe patterns and examine graphs to determine if there are relationships between the variables.  Students will use said relationship to analyze the foot prints found in Ms. Garcia’s garden. |
| **Instructions for Student Accommodations:**  Strategic grouping of students; Review PowerPoint when requested; Behavioral Strategies; Classroom placement/arrangement; Extended time for students when needed; organizational strategies; and technology usage. |
| **Assessment for Activity:**  Informal assessment throughout lab; lab conclusion write-up; cumulative group project will be graded in Plant Biotechnology STEM class. |
| **Approximate Length of Time for Activity:**  Two 50 minute class periods |
| **Materials Needed:**  meter stick, graph paper, notebook, calculator, pencil |
| **Resources Needed:**  Lab handout |
| Attachments: Lengthy Relationships Lab |